

# Recruitment Dynamics of Walleyes (*Sander vitreus*) in a Great Lakes Tributary

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## Abstract

Walleye (*Sander vitreus*) is an important sport fish in the Great Lakes that is experiencing low reproductive success after severe population declines starting in the late 1940s. In the Muskegon River, Michigan, natural reproduction of walleyes remains low and is largely supplemented by stocking. To determine factors influencing walleye reproductive success in Muskegon River, we estimated walleye egg density and larvae drift from April to May in 2009 and 2010. Egg densities were 70-fold higher in 2009 than 2010, but experienced colder water temperatures and higher river discharge rates which resulted in lower egg survival and half the larvae production measured in 2010. Our results suggest abiotic factors, primarily temperature and flow, control early survival and potential recruitment of walleyes in Great Lakes tributaries.

## Introduction

The Muskegon River (Figure 1) historically supported one of the largest runs of adfluvial walleye in Lake Michigan. Adult walleye abundance in the Muskegon River has been stable and at moderate levels since 1986, but natural reproduction is low and the population has been supported by stocking since 1978. Competition and predation by alewife (*Alosa pseudoharengus*) in Muskegon Lake were considered the primary factors affecting low recruitment in this system, however recent studies indicate low larval fish densities in and below the spawning areas of the Muskegon River.

## Objectives

1) Estimate egg density and larvae drift from Muskegon River to nursery areas in Muskegon Lake. 2) Relate egg and larvae densities to environmental factors.

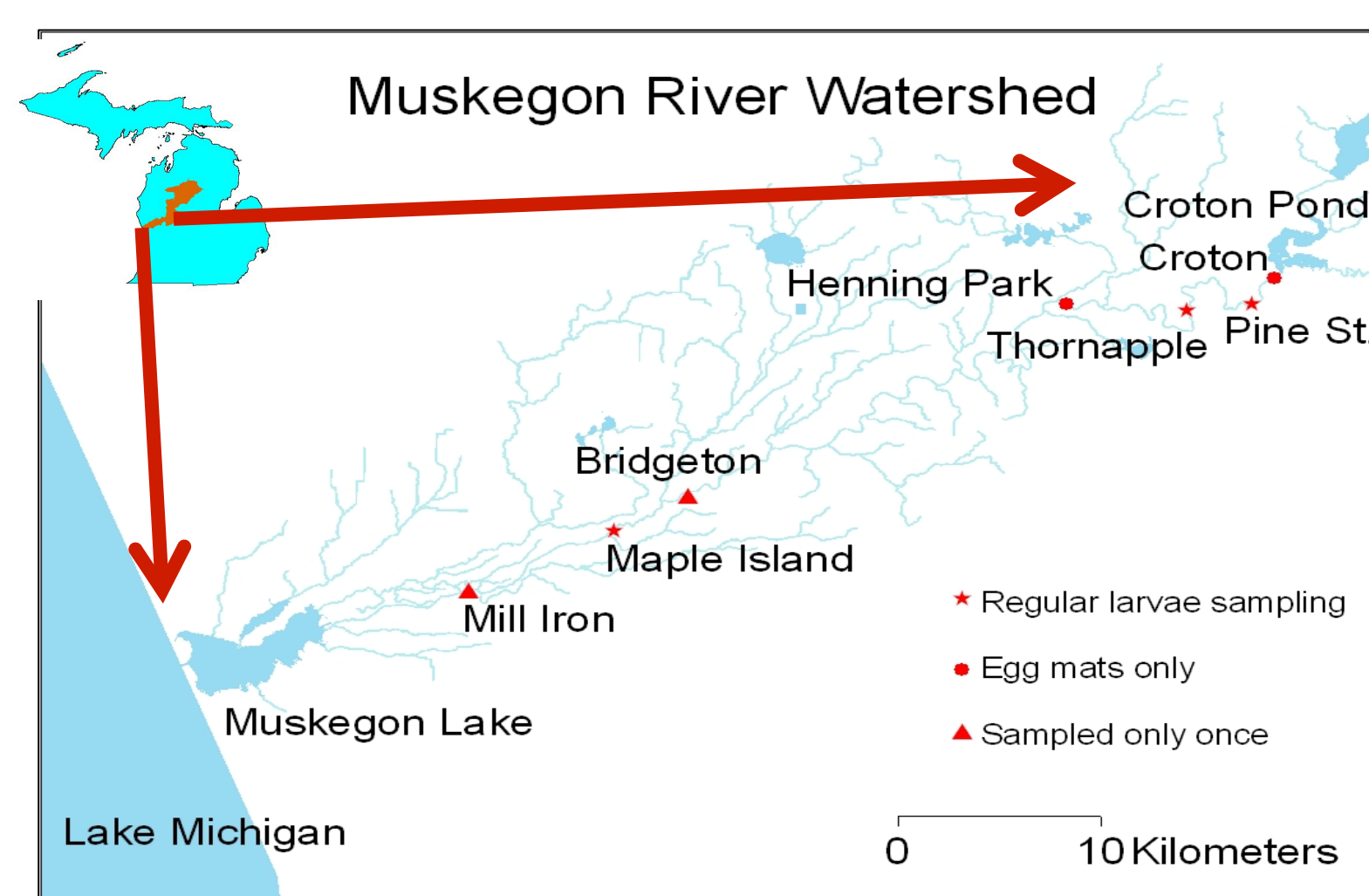


Figure 1. Study area and sample sites for eggs and larvae in the lower Muskegon River tributary to Lake Michigan.

## Discussion

Despite higher egg densities in 2009, we found better egg survival and higher larvae production in 2010 when river flows were warmer and slower. Physical habitat suitability modeling of Muskegon River (Ivan et al. 2010) confirms that slower water velocities and warmer temperatures experienced in 2010 provide more suitable habitat for walleye eggs. In Lake Erie tributaries, Mion et al. (1998) also found higher walleye larvae survival and production under warmer, slower river flows.

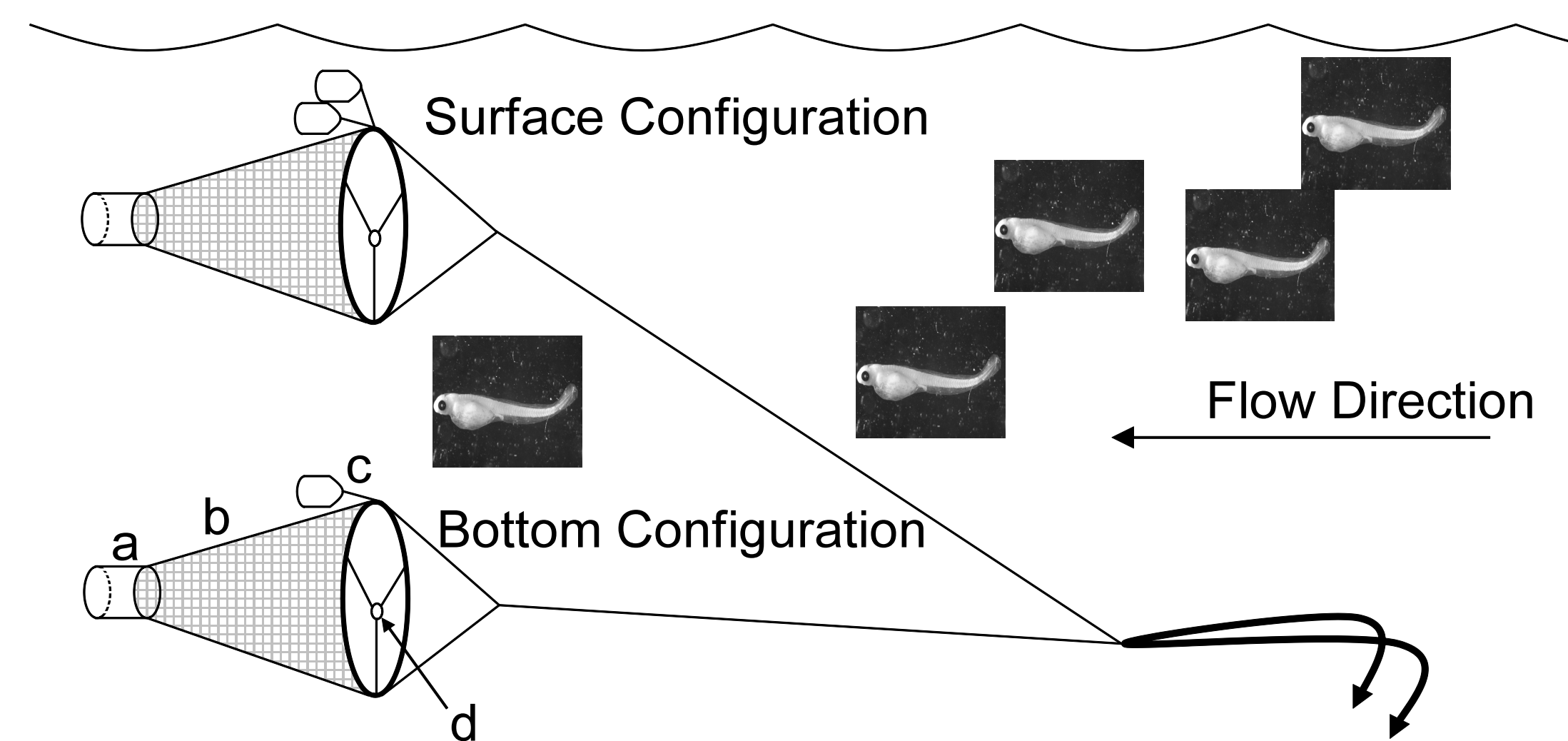
## Methods



Walleye egg densities were estimated from egg samples collected on furnace filter mats placed in-situ on suitable spawning substrates in three areas (see Fig. 1).



Walleye larvae were collected in 10-min, replicate tows of 0.5-m, metered drift nets with 333- $\mu$ m mesh. Nets were set near-bottom and surface of the water column. Water volume sampled was estimated by flow meters (d) at net mouth.



## References

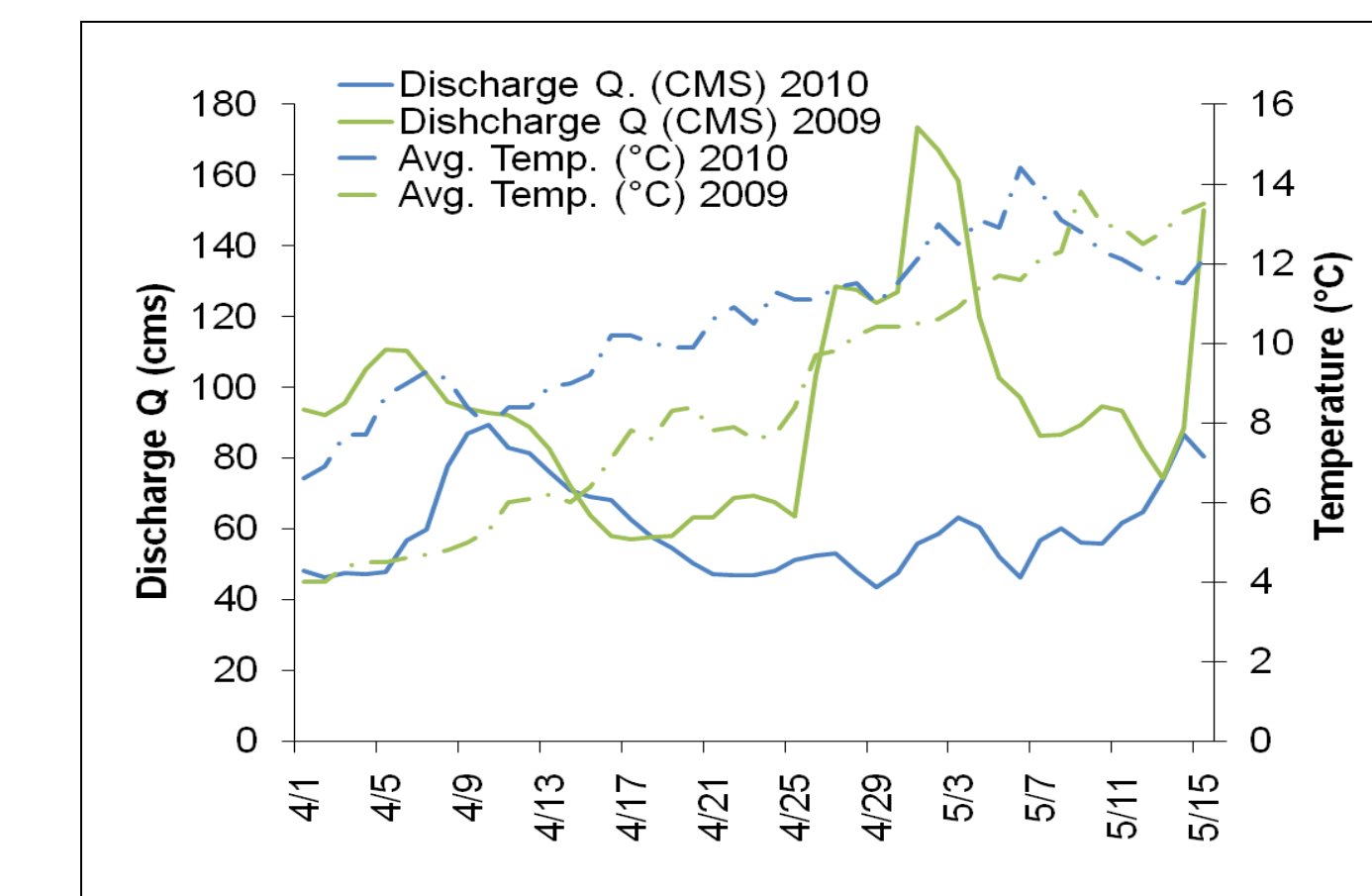
Ivan et al. 2010. Density, production and survival of walleye eggs (*Sander vitreus*) in the Muskegon River, MI. J. Great Lakes Res. 36:328-337.  
Mion et al. 1998. River discharge drives walleye larvae survival. Ecol. Appli. Vol. 8, pp. 88-103.

## Acknowledgements

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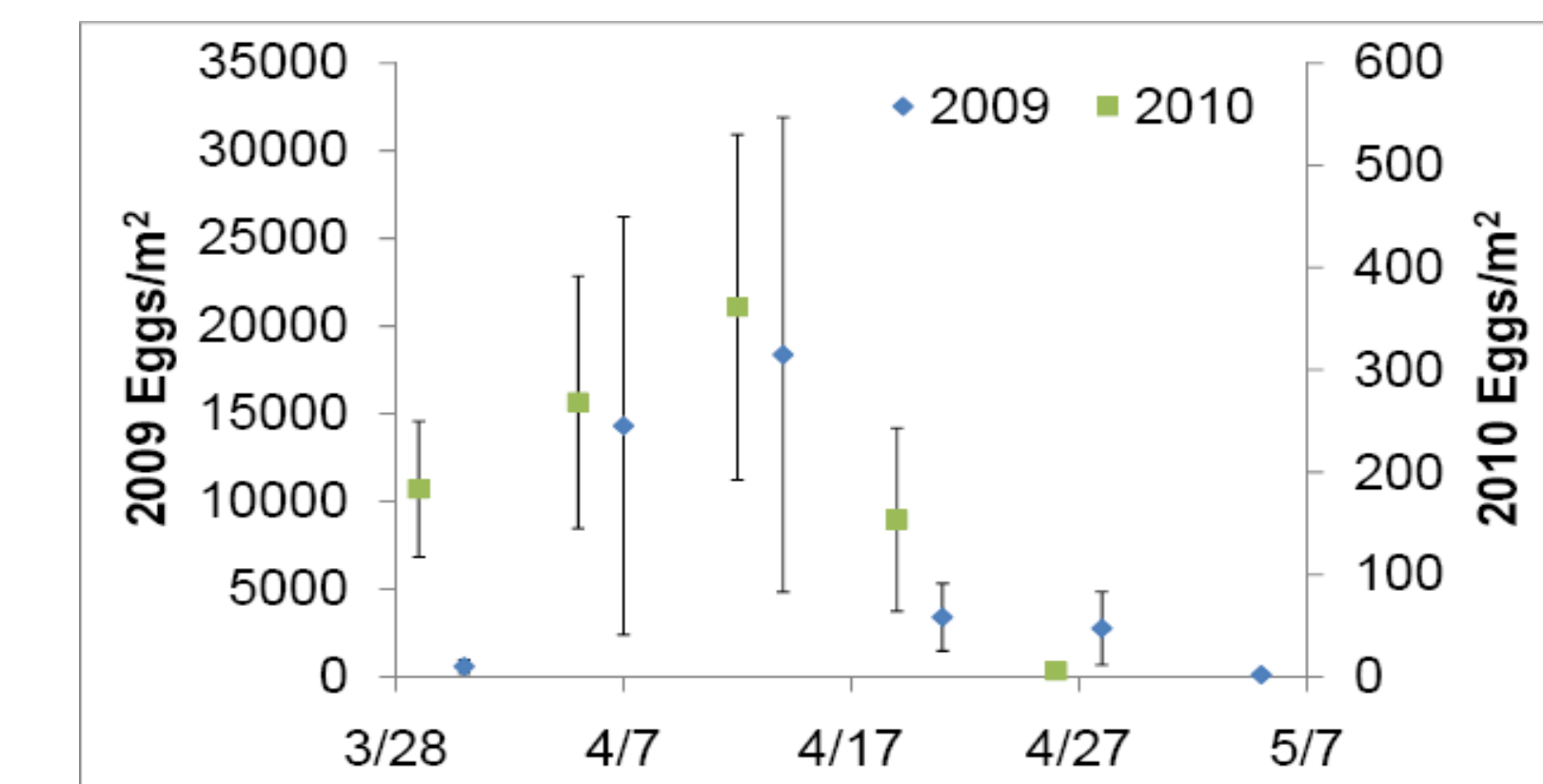
## Results

River flows were warmer, slower, and less variable in 2010.



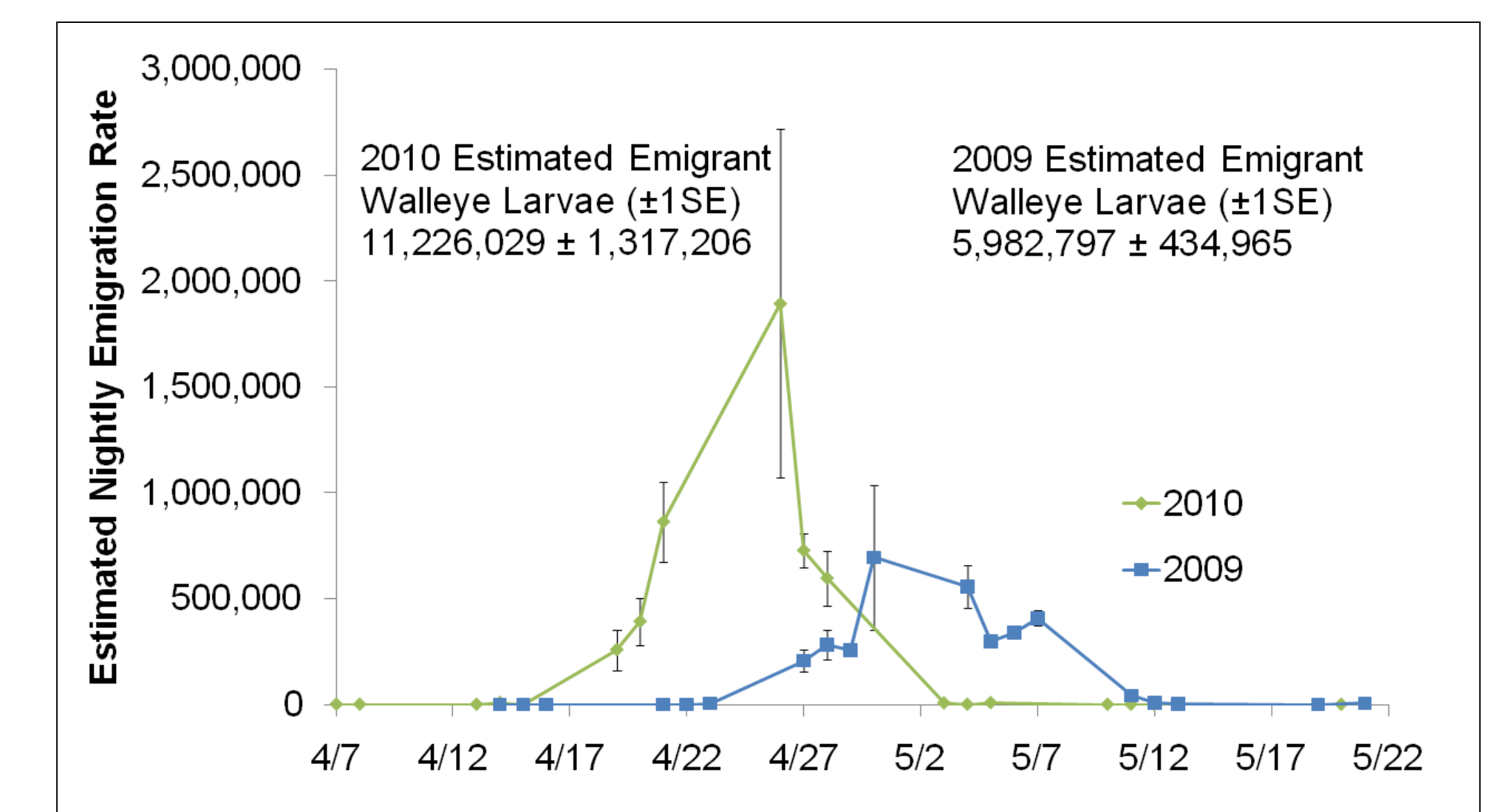
River discharge and temperature at USGS gage station at Croton Dam, Muskegon River from 1 April to 15 May 2009-2010.

Egg Densities were 70-fold lower in 2010 than in 2009.



Note change in y axis from 2009 to 2010.

Larvae production in 2010 was twice that in 2009.



Nightly walleye emigration estimates ( $\pm 1$  SE) from the Muskegon River from April to May, 2009 and 2010. Estimates are based upon nightly discharge at Croton Dam and average nightly densities at upriver sites (Pine St, Thornapple). We assumed 6-hour constant peak in drift each night.

## Conclusions & Future Work

- Physical factors influence egg survival and larvae drift to nursery grounds.
- Future work will identify role of biotic (alewife predation) and abiotic factors on larvae and juvenile survival in nursery grounds in Muskegon Lake.